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• LEAFLET •



NUMBER 163 •

# LEGUMES

IN

## SOIL CONSERVATION PRACTICES



SEP 30 1938  
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# LEGUMES IN SOIL CONSERVATION PRACTICES<sup>1</sup>

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The Soil Conservation Service is engaged in a campaign to save the soils of this country. It has been pointed out repeatedly that millions of acres of land have already been ruined, that other millions are on the road to ruin, and that a still larger area is being slowly denuded of topsoil by sheet erosion, on many acres so gradually that the landowner is not even aware of the loss.

Among the various means that can be used to conserve the soil and, where possible, bring it back to its former productivity the use of plant cover plays an important role. The ideal means of preventing erosion is a complete cover of vegetation, but such a complete cover is seldom practicable since the farmer must grow some cash crops in order to make a living. The utilization of crops planted primarily to conserve soil cannot be overlooked. So far as possible, crops are and must be used that are locally valuable for cash crops, for hay, for grazing, or for maintaining soil productivity. Important among these are legumes.

Both legumes and grasses serve as cover to protect the soil from the impact of rain, to slow down the flow of water on slopes, and to hold the soil in place. Where legumes occur frequently in a rotation the productivity of the soil is maintained, for legumes can take nitrogen from the air and thus add to the store of nitrogen in the soil. But grasses, which need considerable quantities of nitrogen for their best growth, are wholly dependent on the nitrogen in the soil. While usually effective as cover, they are inferior to legumes for maintaining soil productivity in the common 3- to 5-year rotations.

Legumes used in soil-erosion control may be conveniently classified as perennials, biennials, and annuals. The crops belonging to each group have their specific uses. The perennials discussed in this leaflet are alfalfa, *Lespedeza sericea*, and kudzu. Alfalfa is used mainly in the North and West. In the South it may be used where soil conditions are favorable or can be economically made favorable. Outside of the upper Piedmont there are, however, few areas in the southeastern one-quarter of the United States on which alfalfa makes a vigorous growth even when lime and

<sup>1</sup> Contribution from Soil Conservation Service and Bureau of Plant Industry.

phosphates are added. In other sections also, especially in the Northeast, lime and phosphorus may be required. Where alfalfa makes a vigorous growth it is useful as a long-term crop on slopes or as a permanent strip or buffer crop on cultivated sloping fields. Where it can be used, it is desirable since it makes the best of hay and its roots leave in the soil large amounts of organic matter, which reduce the tendency to erosion (fig. 1). In many places a mixture of grass and alfalfa give better control than alfalfa alone.



FIGURE 1.—Alfalfa as a strip crop. A permanent legume strip checks run-off and strains out the silt.

In the South, where alfalfa is not commonly successful, *Lespedeza sericea* may be used as a permanent planting on slopes that should not be cultivated, as a buffer strip in cultivated fields, **Lespedeza sericea** on sloping land in meadow outlets (fig. 2), and for planting in odd corners where it may serve to hold the land and to provide cover and food for wildlife.

It may also be seeded in strips along waterways planted to Bermuda grass. If allowed to maintain a dense shade, *L. sericea* will control the spread of the Bermuda grass into neighboring fields.

Planted on a field already somewhat gullied, *L. sericea* will check further growth of gullies and will smooth out existing small gullies. Even when it is cut for seed late in the season, there will be stubble to check the flow of surface water, and the abundant living root system holds the soil during winter. While *L. sericea* does not start spring growth as early as alfalfa, it makes a green cover earlier than any of the annual legumes.

*Lespedeza sericea* planted as strips in cultivated fields should be in strips wide enough to permit convenient cutting for hay. When used as a border to prevent the spread of Bermuda grass, it should be left uncut except for a seed crop. From such a strip enough seed may be secured to provide additional plantings on the farm. It should also be used freely for wildlife plantings along the margins of woods or in out-of-the-way corners. It may be used in meadows seeded for catching water from terraces, and in such places it may be cut for hay or may be left to attract wildlife.

*Lespedeza sericea* is especially suited to silt or clay loam soils from which the surface soil has already been largely removed. On moderately good soils it does well without the application of lime and fertilizers. On very poor soils, however, lime and fertilizers, especially phosphorus as basic slag or superphosphate, will enable *L. sericea* to make a better stand and more vigorous growth.



FIGURE 2.—*Lespedeza sericea* planted for wildlife. Note the eroding land on the left; no erosion on the right.

*Lespedeza sericea* is a plant of erect habit, like alfalfa, but when cut for hay a stubble of 3 to 4 inches should be left as the new growth comes from the stubble and not, as in alfalfa, from the crown. The weakness of *L. sericea* is that it makes but a slow growth the first season.

Kudzu is a perennial vine with a large root. When it is well established the vines make a growth of 30 to 50 feet in a season. It is, therefore, especially suited for the control of large gullies or for planting on steep slopes that are to be permanently retired from cultivation and for one reason or another cannot be feasibly planted to trees. Planted on the margin of a gully or on suitable places on the sides, kudzu will spread along the gully walls, rooting at the nodes to increase the number of plants, collecting debris and soil as it goes. If mechanical measures are taken to prevent large volumes of water from rushing down such a gully, it will finally be more or less filled and instead of being a menace the gully may be made a useful place where cattle can get a large amount of summer grazing.

When kudzu is planted alongside of cultivated fields, its spread is easily controlled. The growth of any one season is killed by frost, and the spread depends on the establishment of new plants by rooting at the nodes. This rooting takes place in the summer, and the young plants are easily uprooted by the next season's cultivation. Except in extremely favorable situations, kudzu will not attain a

maximum cover before the third season after planting. During the first season it may need cultivation to become well established.

Red clover and sweetclover are mainly used in the North and West. In the Piedmont, in Kentucky, and in Tennessee red clover can be

**Biennial Red Clover, Alsike Clover, and Sweetclover.** grown if suitable attention is paid to liming, the use of phosphates, and the use of adapted strains; but in most of the South the crop is not satisfactory. Many soils in the northeastern United States must be limed for red clover. Where suitable stands and

growth can be secured there is no better legume for use in regular rotations. In the North it lies at the foundation of a permanent agriculture. Red clover, seeded in small grain, will rapidly cover the ground after grain harvest; it fills the soil with roots and during the following season gives complete erosion control. The large amount of organic matter left in the soil when a good clover sod is plowed not only serves to maintain soil productivity but decreases the danger from erosion by increasing the permeability of the soil. Alsike clover is useful in the same way as red clover but makes somewhat less growth and will grow at a lower level of soil fertility than red clover (front cover).

Sweetclover is very dependent upon lime in the soil, but where it will thrive, its role in soil conservation is similar to that played by red clover. The range of sweetclover extends farther west than that of red clover since this species will grow on semiarid land. Under suitable cultural practices it may be grown over a large part of western Kansas and Nebraska, which are subject to wind erosion.

The annual legumes may be subdivided into winter annuals and summer annuals. The use of the winter annuals is most common in the South and on the Pacific coast. With the exception of soybeans,

**Annual Legumes.** canning peas, and Canada field peas the summer annuals are only rarely used north of northern Missouri. All annuals make their growth in one season and must come again from seed the next season. This in some degree limits their use in the soil-conservation program. Some annuals, such as bur-clover, crotalaria, and lespedeza, produce seed at maturity, which, left on the ground, gives rise to a volunteer crop the next season. Such crops can be more economically maintained over a series of years than those crops for which seed must be purchased every year and which require some soil preparation. Crops that require annual seeding are crimson clover, vetch, Austrian Winter peas, cowpeas, soybeans, canning peas, and Canada field peas.

Where a soil not frozen in winter is left exposed to the elements there is a loss not alone of plant food but of the soil itself. A growing crop on such land will protect the soil and conserve plant food. Such a crop may be a cereal or a

**Legumes for Winter Cover.** legume, but the legume is most often turned under in the spring for the benefit of a hoed crop. It will not only serve to protect the soil during the winter but will increase the store of soil nitrogen and organic matter when turned under. This increased supply of organic matter not only helps to maintain soil productivity but decreases the danger from erosion by making the soil more permeable to water. The main crops used for this purpose are crimson clover, the vetches, and Austrian Winter peas. Bur-

clover, sour-clover, and Hubam sweetclover are used to a less extent. All of these have a rather higher lime and fertility requirement than the summer legumes. Winter legumes will not thrive on extremely poor soil. Such soils must be somewhat improved by the use of summer legumes before good stands and growth can be expected. These winter legumes are especially valuable for maintaining the productivity of soils for cash crops as well as for winter protection since they can be grown in a season when cash crops cannot be grown (fig. 3). Legumes used for winter protection are commonly turned under in the spring when the field is prepared for a row crop. During the summer such a field must be protected by mechanical means if the benefits to be expected from winter legumes are to be fully realized.

Annual legumes suitable for summer cover are canning peas, Canada field peas, cowpeas, soybeans, crotalaria, and lespedeza. All Legumes for Summer Cover. but the first two of these have a rather lower lime and fertility requirement than the winter legumes; they will grow on poorer soil. Again, this does not mean that they will not respond to lime and fer-

tilizers. On poor soil they will profit from them decidedly, whereas on soils of fair productivity the addition of fertilizers is not usually profitable. The need for lime and fertilizer will depend on the soil, and their use must depend on local conditions. While a close stand of any of these legumes will protect the soil, the value of the different species for erosion control and for the maintenance of soil productivity is by no means the same. At one extreme stands a crop of soybeans grown in rows and harvested for hay. Such a crop is almost as much a soil robber as cotton or corn. It permits soil erosion and adds little or nothing to the soil. At the other extreme is a dense stand of lespedeza that is moderately grazed. Such a stand makes a complete ground cover, checks run-off, and keeps the soil from going with whatever run-off there may be. Such a stand, if left to volunteer for 2 or 3 years and then turned under, will materially improve the productivity of the soil.

The annual summer legumes of the South are late in starting in the spring since the seedlings make little growth until warm weather. This must in some cases be recognized as a handicap since the soil will be left exposed for several weeks in the spring. This handicap is less in the use of annual lespedeza than of cowpeas or soybeans. When annual lespedezas are sown for the first time they are commonly seeded in winter grain. This protects the land until harvest, and by that time the lespedeza already furnishes considerable if not complete protection.

If the lespedeza is continued on an area for several years the debris left will help to protect the surface during winter and until the volunteer growth is large enough to afford protection. Annual lespedeza is, therefore, one of the best all-round erosion-control crops. It will grow on soil that is only moderately fertile and makes a dense cover from late May until frost. Early cutting for hay, so as to allow time for new growth, or moderate grazing, especially on slopes, will help by leaving some debris on the ground over winter.

Cowpeas, soybeans, and crotalaria are less satisfactory for erosion control than the annual lespedezas. Cowpeas do indeed serve for summer control, but they are late in starting, and the ground must

be worked to prepare a seedbed and thus be exposed to erosion before the cowpeas cover the ground. When cut for hay, a cowpea crop leaves little debris for winter cover.

Soybeans, if broadcast or close-drilled, may also make a good summer cover, but they offer the same difficulties as cowpeas. Soybeans in cultivated rows are in no sense soil-conserving crops.

Crotalaria is mainly grown on sandy land and, when a good stand is secured, makes a splendid cover during summer. Since it is grown almost entirely for soil improvement, the dead material may be left for winter cover and may be worked into the ground the next spring. Most species are not fit for feed.



FIGURE 3.—The Austrian Winter pea is a good winter cover crop in the South. It protects the land and helps to maintain soil productivity.

Canning peas, seed peas, and Canada field peas are grown principally in the Great Lakes States, Montana, and the Pacific Northwest. Unless a companion crop of red clover, sweetclover, or Hubam sweetclover is seeded with the peas, there is danger of serious erosion after harvest. Fortunately, peas make a good companion crop for a clover seeding.

Maintaining Soil Productivity.

Maintenance of soil productivity is to a large extent bound up with the maintenance of organic matter, which serves to decrease the danger from erosion. Legumes take a prominent place in maintaining soil productivity. Winter legumes are most commonly depended on in the South; red clover and sweetclover in the North.

Turning these crops under, wholly or in part, maintains the organic matter at a satisfactory level and adds nitrogen to the soil.

Summer legumes may and do also serve the same purpose. Cowpeas and soybeans harvested for hay do not add materially to the organic matter in soils. At best they serve as a mechanical summer cover. If turned under entirely they serve the same as crotalaria to add to the soil organic matter. Practical experience has shown that the annual lespedezas even when cut for hay will increase the following crop of cotton or corn. Data on the quantities of organic matter left in the soil by such a crop are wanting, but even when

annual lespedezas are cut for hay a considerable quantity of organic material is left, and the resulting increase in crop yields is commonly impressive.

While soil improvement may be effected by the growing and turning under of legumes the more important concern is the prevention

**Prevention of Erosion Important.** of erosion. All cultivation destroys some organic matter, and all crops removed take away some minerals. Both of these processes are insignificant, however, in comparison with the losses from erosion.

Erosion removes the soil and with it the plant food and organic matter. The addition of organic matter helps to prevent erosion by making the soil more permeable to water. The more water sinks into the soil, the less will run off; and the smaller the run-off, the smaller will be the soil loss sustained. Legumes fill a three-fold role: they protect the soil and decrease run-off; they add organic matter, which makes the soil more absorptive of water; and they increase the store of nitrogen in the soil. After the legumes have been turned under, mechanical means must be used to prevent erosion while the field is in a row crop and thus minimize the loss and hold the gains derived from the growing and turning under of the legume crop.

While winter legumes must be turned under in order that the benefit of growing them may accrue to the following crop, there are other ways of using some of the summer legumes that will result in the greatest degree of erosion control.

**Some Special Uses of Legumes for Erosion Control.**

One of these ways is the use of annual lespedezas for grazing. Where adapted, they maintain active growth and furnish an abundance of pasture from June to frost. While doing this they control erosion, even on moderately steep slopes, and leave seed on the ground for the next year's volunteer stand. Wherever erosion control without mechanical means is an important consideration these lespedezas should be planted for grazing and left to volunteer as long as possible. They are useful for seeding on eroding slopes either alone or with Bermuda grass, and on such slopes they will smooth out small gullies and prevent the formation of new ones.

Annual lespedeza should be seeded extensively on idle land. Left unprotected, such land washes away and deteriorates. Lespedeza will give cheap protection, and when the land again comes into a crop its productivity and its power to resist erosion will be greater for having been covered with lespedeza.

The annual lespedezas also lend themselves to a double use of land and at the same time make for more perfect erosion control. In many places a winter grain crop can be drilled into a lespedeza field that is disked after the seed is ripe; or the lespedeza can be left on the ground until spring, and oats drilled in after disking. The grain will assist in winter-erosion control and may be harvested as hay or as grain. The lespedeza volunteers for a grazing crop the next summer. This system produces two crops a year and provides cover for the ground practically the entire time. A similar system has been used with *Lespedeza sericea*.



